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Larval Rearing of Tilapia (*Oreochromis niloticus*) at different levels of feeding in biofloc culture system in Bangladesh: Evaluation of water quality parameters, growth performances, hematological parameters and nutritional quality of biofloc

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Abstract
A 98-day experiment was conducted to determine the growth and feeding of tilapia larvae (*Oreochromis niloticus*) in Biofloc system. The experiment was performed in fiber glass indoor tanks with four levels of treatment *viz*. T1 (control), T2 (normal level of feeding + floc), T3 (25% feed reduction + floc), T4 (30% feed reduction + floc) with 3 replications of each. Fifty tilapia larvae (0.5g/fish) were stocked in 100L of water in each tank and provided a diet of 3% body weight commercial tilapia feed. In this study, Biofloc has a positive impact on maintaining the water quality parameters specially the maintenance of ammonia. There are no significant differences observed in growth among the treatments. Although feeding is reduced to 25% and 30% in T3, T4 respectively, the growth was relatively higher in T3 and T4 than others. However, the FCR of T3, T4 is significantly different ($P<0.05$) than T1 and T2 respectively. Mostly, there were no significant differences observed among hematological parameters between control and Biofloc treatments. Tangling of floc in the gills in the early life stage of tilapia, sudden reduction of DO and fluctuations of ammonia are the main barriers of larval rearing of tilapia in Biofloc system. We advise to start fish culture in Biofloc technology with larger size fish fingerlings rather than fish larvae. More research should be initiated to find the best stocking density and feeding level in Biofloc in a better experimental setting.

Keywords: tilapia larvae, biofloc technology, water quality parameters, bacteriological analysis, proximate composition, growth performance, hematological parameters

Introduction

It has been reported that from 2001-2018, global aquaculture production of farmed aquatic animals increased at an annual pace of 5.3 percent on average (FAO, 2020) [48]. New technology and intense aquaculture practices had a great impact to boost aquaculture production. However, it is estimated that fish retains at least 20-30% of feed nutrients (Avnimelech and Ritvo, 2003) [37]. Because of the quick buildup of organic and inorganic nitrogenous and phosphorus compounds caused by intensive aquaculture, the ecosystem is harmed. So, to reduce environmental harm and boost sustainable aquaculture output, creative solutions are needed (Avnimelech, 2009) [12]. A potential method for regulating wastewater and recycling nutrients is biofloc technology (BFT) (Devi and Kurup, 2015) [43] through balancing the C\N ratio. The culture system of biofloc is made up of bacteria, algae, fungus, ciliates, rotifers, nematodes, and detritus (Manan *et al.*, 2017).

In the culture system, a balanced C/N ratio promotes the development of heterotrophic bacteria, nitrogen absorption, and microbial biomass. The microbial protein thus produced may be used as a rich food source by tilapia and shrimp, resulting in the recycling of feed and protein (Avnimelech, 2007) [5]. Because of a physiological adaption, tilapia can ingest and digest microbial protein produced by the biofloc system (Hargreaves, 2013) [32]. High growth rate, endurance for a variety of environmental situations, including high density, and feeding on low trophic levels (El-sayed, 2019) [27], has elevated tilapia to the status of the second-largest farmed fish in the world (after carp), with more than 6.5 million metric tons produced in 2019 and an average yearly growth rate of 4% compared to the previous year (Tveteras *et al.*, 2019). In aquaculture, the majority of operating costs more than 50% of overall costs are related to food (Pacheco-Vega *et al.*, 2018). In order to improve the efficiency of feed utilization, nitrogen retention and elimination of artificial feed inputs, biofloc has the capacity to make up for food loss by recovering expelled nutrients and uneaten feed by bacteria (Emerenciano *et al*., 2012) [24].

According to Amany *et al.*, 2019, tilapia fry fed at 80% of usual feeding rates in BFT showed growth performance that was comparable to that of the group receiving standard feeding. Therefore, it is important to research restricted feeding levels to reduce food intake without affecting Nile tilapia fry growth performance. Biofloc technology is continually evolving in Bangladesh despite the adoption of several fish species cultures. As a result, small-scale farmers have not effectively embraced and populated the core concept and methods of biofloc technology. The impact of BFT on tilapia fry, which are critical to the aquaculture of this fish, is still unclear. *O. niloticus* is now a significant aquaculture species in Bangladesh due to its quick development rate, high productivity, and strong disease resistance. Tilapia in biofloc systems has been the subject of a number of research. (Avnimelech, 2007; Azim and Little, 2008; Ekasari *et al*., 2014; Perez- Fuentes *et al*., 2018) [4, 9, 50], Few studies, particularly during the larval culture stage, have tried to determine the impact of slowing down feeding. Therefore, producers may alter feeding rates without incurring any additional costs; as a result, finding the ideal concentrations of these components could increase feed effectiveness and help to maximize the use of BFT.

As a result, the objective of current study is to determine the water quality, bacteriological analyses and proximate analysis of biofloc, hematological parameter and growth performance of Tilapia larvae (*Oreochromis niloticus*) using different feeding level in the biofloc culture system. Additionally, the nutritional value of the biofloc and fish was examined, which may offer information about examining the impacts of BFT on aquatic species.

Materials & method

1. Tank facilities and experimental design

The project work was carried out at the Laboratory of Aquaculture, Faculty of Fisheries, Sylhet Agricultural University, Sylhet. Four levels of treatment and 3 replications of each was performed in twelve units of indoor rectangular fiber glass tanks (170L capacity) and the tested treatments were namely T1 (control), T2 (normal level of feeding + floc), T3 (20%feed reduction + floc) and T4 (30% feed reduction + floc). All the tanks were cleaned, dried and filled with freshwater (100 L). Air-stones attached to an air pump continuously stirred and aerated the tank water. The air-stone had a 15 mm diameter, whereas the aeration tube had a 4 mm diameter. Large glass windows allowed for a lot of natural light to enter the laboratory where the test was run. The group with sugarcane molasses addition was referred to as the BFT treatment; the control group did not receive molasses. Prior to the start, tanks were washed using potassium permanganate and then dried for the next 24 hours. The carbon to nitrogen ratio was maintained at 10:1 in the biofloc tanks with the supplementation of sugarcane molasses; the amount of carbon was reduced in the tanks. The adjustment of C/N ratio and carbon content of sugarcane molasses were adopted in the experiment according to Avnimelech (2007) [17] and Samocha *et al*., (2007) [45]. The daily mortality was recorded to calculate the survival rate. The experiment lasted for 98 days.

2. Fish stocking and feeding

Monosex tilapia (*Oreochromis niloticus)* were collected from a fish hatchery of Mymensingh, Bangladesh and were transported in oxygenated plastic bags filled with freshwater. The fish were acclimatized for one week prior to the commencement of the study and were fed to apparent satiation with a commercial floating feed. Fingerlings (0.53 ± 0.19 g, n = 600) were randomly distributed into 12 tanks with a stocking density of 50 fishes per tank. The fish were fed with a commercial diet containing (37%) protein. When we started the experiment, it was winter period and fish tended to take lesser food than general; so, feed was provided according to 3% body weight of fish. The daily ration was presented in two equal portions at 9:00 a.m. and 8:00 p.m. The weight of 30 fish from each tank was measured fortnightly to adjust the feeding rate, and the feed inputs were recorded daily for each tank.

3. Assessment of water quality parameters

Temperature, pH, Dissolve Oxygen (DO) and Total Dissolved Solids (TDS) were all measured daily using a YSI ProQuatro Multiparameter Water Quality Meter during the 14-week experiment. Weekly analyses of ammonia, nitrate, and nitrite were conducted using a commercial test kit (API, China). Using the Life Sonic Alkalinity Test Kit, the alkalinity of culture water samples was determined every three days. Floc volume (FV; ml/L) was determined on site using Imhoff cones every 3 days, registering the volume taken in the flocs in 1,000 mL of tank water after 30 min sedimentation which was also followed by (Avnimelech and Kochba, 2009) [3].

4. Fish hematological parameters

Using a heparin-coated syringe, blood was taken from the caudal vein of fish in the control and Biofloc-treated groups after 56 days. In K3-EDTA tubes with a thin coating of EDTA and chelated potassium ion as an anticoagulant, the collected blood was maintained. At a temperature of 4°C, these tubes were gently shaken. Collected blood samples from the experimental and control groups were utilized to determine various hematological parameters using a hematology analyzer. The hematological variables that were evaluated were HGB (g/dl), RBC (m/ul), WBC (/Cumm), Platelets (/Cumm), LYMP (%), MONO (%), GRA (%), HCT (%), MCV (fl), MCH (pg), MCHC (g/dl), RDW (%), PDW (pg), MPV (m^3) and PCT (%).

5. Growth measurements

In the experiment mean final body weight (FBW), weight gain (WG), specific growth rate (SGR %), feed conversion ratio (FCR), protein efficiency ratio (PER), Protein Conversion Ratio (PCR) were calculated using the following equations:

- Specific growth rate (SGR, % day−1) = 100 × [ln(final body weight) − ln(initial body weight)] ⁄ (days of experiment)
- Survival rate (%) = 100 × (final fish count/initial fish count),
- Weight gain (%) = 100 × (final body weight − initial body weight)⁄initial body weight,
- Feed conversion rate (FCR) = total dry weight of feed supply⁄total fish wet biomass increase
- Protein efficiency ratio (PER) = total fish wet biomass increase/total dry weight of feed protein consumed
- Protein Conversion Ratio (PCR) = FCR X [Feed crude protein content% /100]

6. Proximate composition analysis

A fortnightly collection of biofloc samples was done for proximate analysis. Concentrated floc samples were extracted from each tank using a floc separator, dried at 102°C until constant weight, crushed, and processed for proximate analysis in accordance with the Association of Official Analytical Chemists' recommended protocols (AOAC 1997) [7]. A known quantity of dry material was burned at 550 °C for 4 hours in a muffle furnace to determine the amount of ash present. The ash was then cooled and weighed. Nitrogen was measured using the Kjeldahl method, and the result was multiplied by 6.25 to get the crude protein concentration. By extracting ether with a Soxhlet extractor, the crude lipid content was determined.

7. Statistical analysis

Using the statistical program SPSS version 26.0, one-way ANOVA was performed on all of the data (SPSS, IL, USA). The Tukeys HSD test at P<0.05 was used to compare significant differences for all the treatments. Microsoft excel (MSO 2016, Version 2205) was also used for several data analysis and graphical representation.

Results and discussion

1. Water quality parameters

The output of water quality parameters in this experiment are shown in Table 1. There were no significant differences in temperature and pH among different treatments (P > 0.05). DO was maintained at a level greater than 5 mg L−1 and differed significantly between (T1, control) and other treatments (T2, T3, T4) (P < 0.05). This likely resulted from the higher respiration rates caused by the bacteria and other microorganisms in the BFT treatments. Similar results were reported in other studies (Emerenciano *et al*., 2012; Kim *et al*., 2014) [24, 34]. However, the DO level in the BFT treatment was well within the acceptable range for the survival and growth of fish. The optimal temperature to maintain floc stability ranges from 26 to 32 °C; temperature fluctuations also affect the biofloc fish culture media (Azim and Little, 2008) [4]. According to (Avnimelech, 2007) [17], a pH value below 6.5 or greater than 9.0 will decrease fish's growth potential. The pH values observed in our analyses were optimal. TDS and alkalinity were lower in (T1, control) than other treatments and differed significantly between (T1, control) and other treatments (T2, T3, T4) (P < 0.05). The TDS observed in this study was within the recommended level of <1000 mg/l (Setiadi *et al.* 2019) [46]. According to Setiadi *et al.* (2019) [46], the state of TDS in the study was sufficient for fish growth. Several authors have indicated that a similar trend of TDS concentration is beneficial to fish growth and the stability of the Biofoc system (Dauda *et al.* 2017; Ray *et al*. 2010; Schveitzer *et al.* 2013) [21, 44]. Higher values of alkalinity will help the nitrogen assimilation by heterotrophic bacteria and nitrification process by chemoautotrophic bacteria (Emerenciano *et al.,* 2017) [25].

Table 1: Comparison of water quality parameters in the control group and biofloc technology (BFT) treatment during the 14-weeks experimental period.

Parameter	T1(Control)	T2 (normal level of feeding +flock)	T3 (25%feed reduction +flock)	T4 (30% feed reduction +flock)	Ideal and/or normal observed ranges (Emerenciano *et al.* 2017; Bhatnagar *et al.*2013; Setiadi *et al.* 2019) [25, 46]
Temperature	23.68±1.87^a	23.69±1.84^a	23.67±1.83^a	23.71±1.76^a	28–30° (ideal for tropical species)
pH	7.82±.22^a	7.86±.12^a	7.89±.13^a	7.84±.13^a	6.8–8.0
Dissolved oxygen	6.39±.78^a	5.47±.40^b	5.51±.52^b	5.36±.26^b	Above of 4.0 mg/L−1 (ideal) and at least 60% of saturation
TDS	110.72±38.38^a	616.47±80.77^b	556.77±78.95^b	592.28±70.57^b	<1000 mgL^{-1}
Alkalinity	98.10±14.12^a	250±36.67^b	254.29±35.10^b	235.71±26.92^b	More than 100 mg L−1

Each value represents mean ± S.E. (n=6). Means in the same row with different superscripts are significantly different at P<0.05.

Daily changes and level of ammonia fluctuation of different treatments has been shown on graph (Figure 1.a). There were significant differences in ammonia level occurred between control and different BFT treatments till the end of the experiment (P < 0.05). Ammonia was always higher and fluctuated in control tank as opposed to other experimental tanks ammonia were well maintained and quite similar in T2, T3 and T4. Ammonia level in T1 (control tank) was always more than 1 mg/L but for biofloc treatments it always existed below 1mg/L. Maximum level of ammonia in T1, T2, T3 and T4 were 1.84±0.96 mg/L, 0.97±0.84 mg/L, 0.9±0.39mg/L, 0.83±0.24 mg/L respectively. The formation and development of flocs are directly related to assimilation of nitrogenous compounds (Ebeling *et al*., 2006) [26]; Timmons *et al.* (2002) [49] indicated that ammonia levels less than 3.0 mg/L are safe for warmwater fish farming like tilapia.

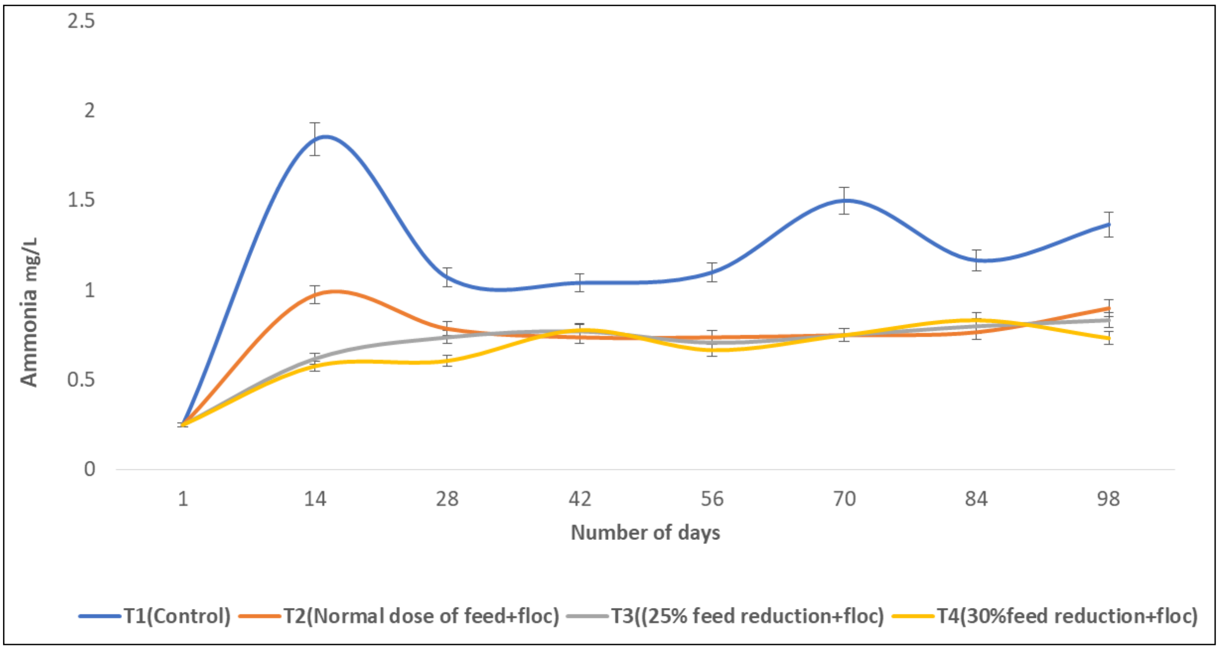

Fig 1.a: Concentration of ammonia (mg/l) throughout the experimental period

Daily changes and level of nitrite fluctuation of different treatments shown on graph (Figure 1.b). There were significant differences in nitrite level occurred between control and different BFT treatments till the end of the experiment ($P < 0.05$). Nitrite was always higher in control tank as opposed to other experimental tanks. On the 64th day the nitrite level of T1 treatment was at its maximum (3.50±0.57 mg/L). On the 56th day, the nitrite level of T2 & T3 treatments were at their maximum; that were 0.94±0.11mg/L, 0.90±0.61mg/L respectively. On the 70th day the nitrite level of T4 treatment was at its maximum (1.03±0.19 mg/L). After reaching the maximum level, the nitrite of T2, T3, T4 started decreasing. Ideal or normal observed ranges of nitrite is less than 1 mg L−1 (Emerenciano *et al.* 2017) [25].

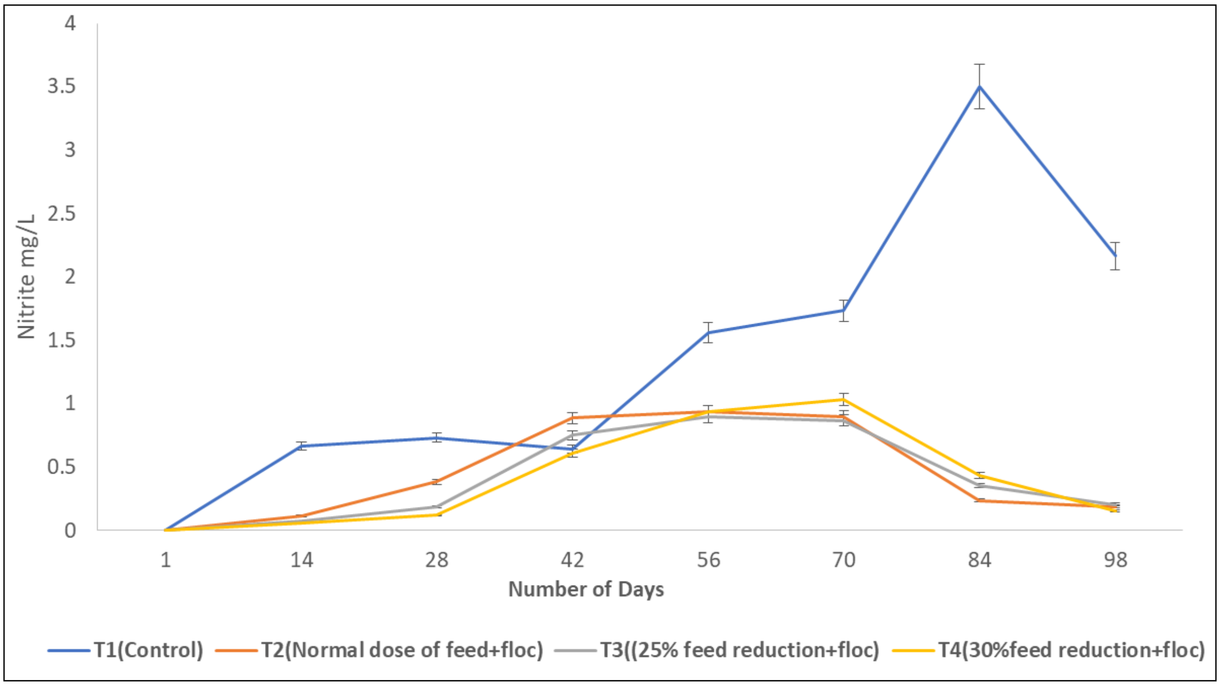

Fig 1.b: Measurement of nitrite concentration (mg/l) throughout the experimental period

The nitrate concentration in the control group fluctuated throughout the culture period (Fig.1.c) and a similar trend was observed in different BFT treatments. On the 56th day nitrate level of T2, T3, T4 treatments were at their maximum; that were 13.75±4.33mg/L, 11.67±2.46mg/L, 12.17±4.28mg/L respectively which then gradually decreased over time. The nitrate concentration was significantly higher in the control ($P < 0.05$), and showed a tendency to accumulate in the first 70 days of the culture period to levels of 20.00±3.27 mg/L. However, this level decreased and then increased again on 98th day. The accumulation of nitrite and nitrate in the first few weeks may have been caused by nitrification processes, which are common in BFT systems (Azim and Little, 2008; Widanarni *et al*., 2012; Xu *et al.*, 2012a; Zhao *et al.*, 2012) [4, 50, 54, 55]. However, the reduction in nitrite and nitrate of the experiment likely occurred due to immobilization by heterotrophic bacteria, which inhibited the nitrification process. In addition, denitrification may have occurred during the experiment (Azim and Little, 2008; Luo *et al*., 2013) [4, 39].

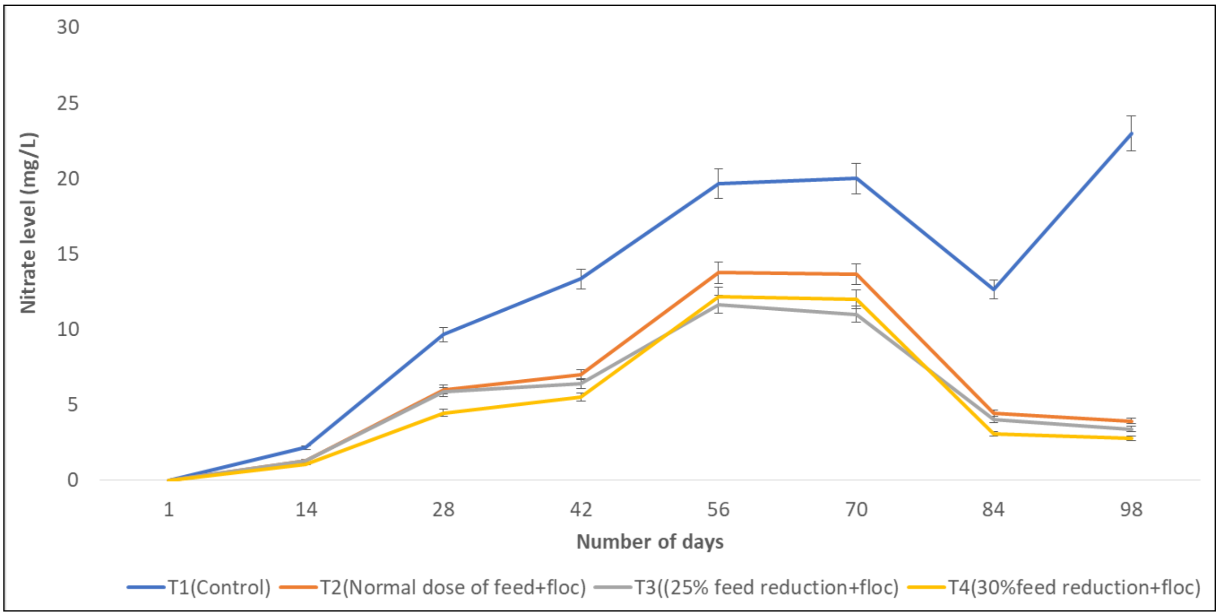

Fig 1.C: Measurement of nitrate concentration (mg/l) throughout the experimental period

Significant differences in the floc volume of different biofloc treatments with control tank were observed and floc volumes in all the biofloc treatments has been observed to fluctuate throughout the experimental period ($P < 0.05$) (Figure 1.d) We observed lower DO level during mid night & morning time in our experiment. However, there is a possibility of depletion of DO during morning time according to Setiadi *et al.* (2019) [46], if the volume of floc is greater than 50 mg/l. In this study, to prevent the increment of floc volume greater than 50 mg/l, we maintained the floc volume at the required level by adding water and removing the settled matter a 1-week interval.

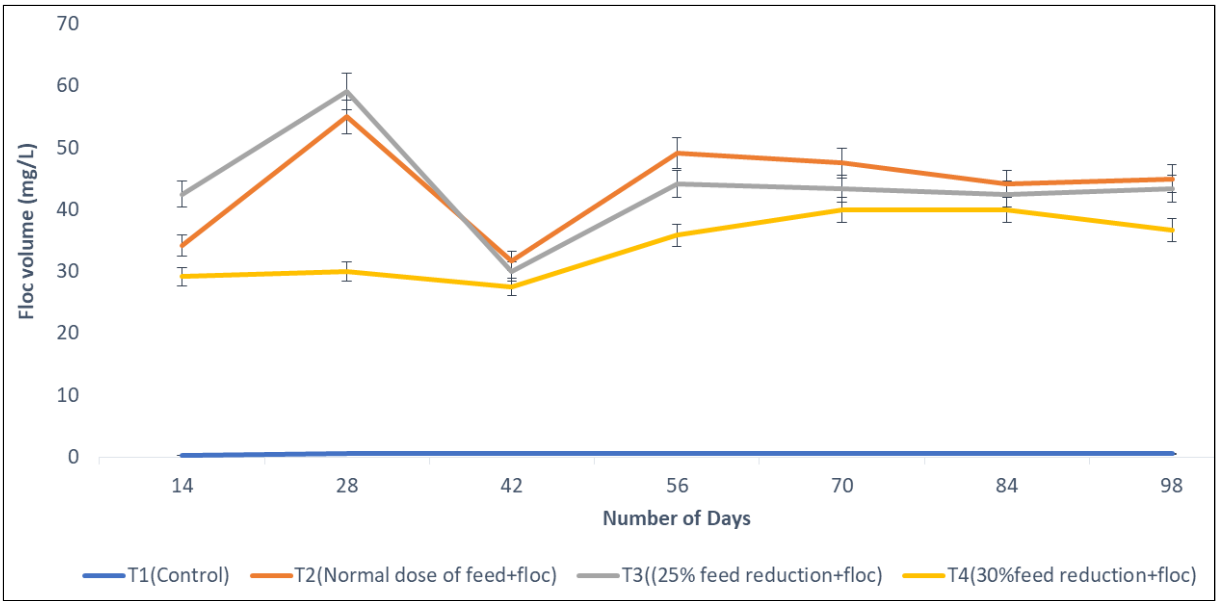

Fig 1.d: Floc Volume (mg/l) throughout the experimental period

2. Growth Parameters and feed utilization

There were significant differences in FCR between control and other treatments. For SGR, PCR, PER there were no significant differences among treatments. Survival rate was higher in biofloc treatments than control treatment. Control tank shows higher final individual weight than other treatments. But there were no significance differences in final individual weight in different treatments of biofloc. In addition, biofloc has been demonstrated to be an effective potential food source for tilapia using a stable nitrogen isotope labelling technique (Avnimelech, 2007) [17]. Avnimelech *et al*. (1994) [6] also estimated that tilapia in BFT ponds was fed a ration 20% less than conventional amounts, while feed utilization was higher. Similar results were observed in the present experiment, i.e., the FCR in the BFT treatment was lower than that in the control. Luo *et al*. (2014) [37] concluded that WG, SGR and FCR of tilapia were better in biofloc system than RAS system. Long *et al*. (2015) [40] noted the same results for tilapia. Furthermore; Ekasari *et al*. (2015) [23] demonstrated better productive performance of Nile tilapia larva under biofloc condition was gained.

Table 2: Growth Parameters and feed utilization of tilapia growing in the control and biofloc technology (BFT) treatment at the end of 14-week experimental period. Means in the same row with different superscripts are significantly different at P<0.05.

Parameter	T1 (Control)	T2 (normal feeding +floc)	T3 (25% feed reduction +floc)	T4 (30% feed reduction +floc)
Initial Individual Weight (g)	0.53±.15	0.53±.21	0.53±.17	0.53±.14
Final Individual Weight (g)	10.94±.66^a	10.10±.59^a	10.02±.52^a	9.87±.26^a
No. of Fish/tank	50	50	50	50
Survival rate (%)	74%	84%	86%	86%
FCR	1.03±0.44^a	1.46±0.25^a	0.79±0.068^b	0.70±0.04^c
SGR	3.15±0.04^a	3.07±0.04^a	3.05±0.03^a	3.03±0.02^a
PER	0.69±0.02^a	0.94±0.19^a	0.59±0.04^a	0.54±0.02^a

3. Hematological Parameters

Analyzed result of hematological parameter between control and Biofloc group is given in the table 3. We can see that there is no significant differences among the treatments in case of HCT, LYMP, MCV, RDW, PDW, MPV, Mono, Gra, MCH, MCHC, PCT (P >.05). The HGB, RBC, WBC levels were found to be significantly higher in Biofloc treatments compared to control (P<.05); whereas the Platelets was found to be significantly lower in Biofloc treatments compared to control (P<.05). Hematological indices are crucial markers for determining the physiological health, illness, and stress tolerance of fish (Haghparast, Alishahi, and Ghorbanpour 2020). RBC and WBC levels that are rising suggest that fish are in excellent health, which aids in preventing illnesses and stressful situations from affecting them by triggering non-specific immune responses. There isn't much information in the literature about how the BFT system affects hematological variables in fish species, but Xu and Pan (2013) [37] discovered that total hemocyte count in shrimp was significantly higher in biofloc treatments than in the control group, which was consistent with the results of the current study. (Long *et al*., 2015) [40] found that as compared to the control group, biofloc had no discernible impact on RBC, WBC, Hb, or Ht.

Table 3: Hematological parameters of tilapia reared in the control and biofloc technology (BFT) treatment at the end of 14-week feeding experiment. Each value represents mean ± S.E. (n=6). Means in the same row with different superscripts are significantly different at P<0.05.

Parameter	T1 (Control)	T2 (normal dose of feed +flock)	T3 (25%feed reduction +flock)	T4 (30% feed reduction +flock)
HGB (gdL−1)	8.25 ± 1.34^a	10.10 ± 1.41^b	10.33±1.25 ^{b}	10.12±1.27 ^{b}
RBC (million/cumm)	1.45 ±.11314^a	1.51±.30^b	1.51±.47 ^{b}	1.51±.07 ^{b}
WBC X 10^4 (per cumm)	12.26±.71^a	14.35±1.20^b	14.32±.86 ^{b}	14.30±.77 ^{b}
PLATELETES X 10^4 (per cumm)	78.05±17.32^a	26.15±3.04^b	28.12±3.67^b	28.15±4.13^b
LYMP (%)	80.55±9.97^a	82.40±6.50^a	80.88±8.45 ^{a}	80.72±6.69 ^{a}
MONO (%)	7.05± 2.61^a	6.65±2.47^a	6.68±3.07	6.62±2.65 ^{a}
GRA (%)	10.40± 7.35^a	10.95± 4.03^a	10.92±6.11 ^{a}	10.88±5.57 ^{a}
HCT (%)	19.85± 2.47^a	19.75± 6.01^a	19.34±6.21 ^{a}	19.54±3.43 ^{a}
MCV (fl)	147.65± 6.43^a	147.35±10.53^a	147.77±6.39 ^{a}	147.26±7.11^a
MCH (pg)	63.65±4.31^a	64.05±4.17^a	63.95±3.87 ^{a}	63.89±4.11 ^{a}
MCHC (g/dl)	40.55±.91^a	40.85±5.58^a	40.33±3.56^a	40.76±2.24^a
RDW (%)	40.20±3.39^a	40.95±1.06^a	40.93±1.17^a	40.22±1.82^a
PDW (pg)	8.30±1.13^a	8.80±.98^a	8.75±.67^a	8.69±.73^a
MPV (m^3)	8.04±1.69^a	7.90±.56^a	7.94±.77^a	7.91±.47^a
PCT (%)	.64 ±.01^a	.60 ±.009^a	.62±.010^a	.63±.008^a

4. Nutritional content of biofloc

The proximate composition of the biofloc collected from the tanks of different BFT treatment is presented in Table 4. The feed was used in control treatment consisting crude protein, crude lipid & ash were 37%,8% & 16% respectively. The Proximal study revealed significant differences in nutritional quality between control and different biofloc treatments ($P < 0.05$). The amount of protein in different biofloc treatments were found to be higher than control tank. The highest percentage of crude protein obtained with T1 (40.03±.09%) and the lowest percentage of crude protein obtained with T4 (39.55±.07%). Some authors suggest that 25-30% crude protein in diets is appropriate for the growth of tilapia (Chou and Shiau, 1996; Jauncey, 2000) [16, 33], which indicates that the crude protein level of biofloc in our study was suitable. T1 treatment having the highest lipid content (4.25±.11%) and the lowest percentage of crude lipid obtained with T4 (3.97±.09%). The crude lipid content of biofloc in the BFT treatment was lower than the level (2-5%) found in other studies (Azim and Little, 2008; Azim *et al.*, 2008; Crab *et al.*, 2010) [4, 9, 18], it was higher than the value (0.47%) reported by Emerenciano *et al.* (2012) [24]. However, the content was not sufficient according to the dietary lipid requirement of 5-12% for tilapia (Lim *et al.*, 2009) [38], suggesting that commercial feed will be still needed for these fish. In terms of ash content in biofloc treatments, T1 treatment having the highest ash content (9.09±.06%) and the lowest percentage of ash obtained with T4 (8.93±.06%). Some authors also suggested that the ash content of fish diets should be less than 13% (Craig and Helfrich, 2009; Tacon, 1988) [15, 48]. Bioflocs with more than 38% crude protein, 3% lipids, 6% fiber, and 12% ash (based on dry matter) are suitable for tilapia production, according to Azim and Little (2008) [4]. In addition, Webster and Lim (2002) [51, 53] reported that bioflocs containing 50% crude protein, 4% fibre and 7% ash (on dry matter basis) are better for herbivorous/omnivorous fishes including tilapia.

Table 4: Proximate parameters of biofloc collected from tanks of different treatment

Composition (% DM)	T1(Control) Commercial feed	T2 (normal dose of feed +flock)	T3 (25%feed reduction +flock)	T4 (30% feed reduction +flock)
Crude protein	37.00%^{a}	40.03±.09%^{b}	39.85±.11%^{b}	39.68±.07%^{b}
Crude lipid	8.00%^{a}	4.25±.11%^{b}	4.14±.13%^{b}	3.97±.09%^{b}
Ash	16.00%^{a}	9.09±.06%^{b}	8.97±.07%^{b}	8.93±.06%^{b}

Conclusion

In this experiment it is revealed that Biofloc treatments have a more beneficial impact and have better control over all of the water quality measures than the control treatment. However, the control treatment caused more overall weight increase in each person than the Biofloc treatment. The Biofloc, however, had a greater survival rate. Despite the fact that we used less feed in the Biofloc treatments, they had a more favourable impact on FCR, SGR, PCR, and PER than the control treatment. Most haematological metrics did not significantly differ between the control and Biofloc treatments. We suggest beginning fish culture using larger fish fingerlings rather than fish larvae when using the Biofloc technology. We recommend that future research concentrate on identifying the best fish species to cultivate using Biofloc technology in the context of Bangladesh as well as isolating good probiotic species for Biofloc fish farming. To determine the gaps in Biofloc technology in Bangladesh KAP (Knowledge Attitude Practise) analysis can be performed.

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